

GAO

United States General Accounting Office

## Testimony

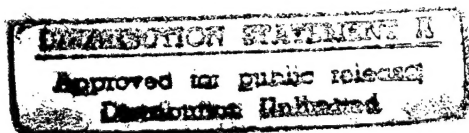
Before the Subcommittee on Military Procurement,  
Committee on National Security, House of Representative

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# CHEMICAL WEAPONS AND MATERIEL

## Key Factors Affecting Disposal Costs and Schedule

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Division



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Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss our work concerning the Department of Defense's (DOD) management of the programs for destroying the U.S. stockpile of chemical munitions and planning for the disposal of nonstockpile chemical warfare materiel. Since 1988, the Congress has appropriated \$4.2 billion for the disposal programs, and DOD estimates that \$23.4 billion more will be needed to complete them.<sup>1</sup> The Army is working to complete the stockpile program by the congressionally mandated date of December 31, 2004, and estimates that the nonstockpile program will take nearly 40 years to complete. Appendix I provides appropriation and expenditure data for the programs for fiscal years 1988 through 1997. Appendix II provides estimated funding data for the programs for fiscal years 1998 through 2005.

Since 1990, we have issued a number of reports addressing opportunities to improve various aspects of these disposal programs. In February 1997, we issued a report that discussed the key factors affecting the costs and schedules for the chemical weapons and related materiel disposal programs.<sup>2</sup> As requested, my statement today provides an overview of our February report and includes a discussion of the chemical stockpile and nonstockpile program, actions the Army has taken to improve the programs, and alternatives to the current approach.

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## Results in Brief

While there is general agreement about the need to destroy the chemical stockpile and related materiel, progress has slowed due to the lack of consensus among DOD and affected states and localities about the destruction method that should be used. As a result, the costs and schedules for the disposal programs are uncertain. However, they will cost more than the estimated \$23.4 billion above current appropriations and take longer than currently planned. The key factors affecting the programs include the public concerns about the safety of incineration, the environmental process, the legislative requirements, and the introduction of alternative disposal technologies.

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<sup>1</sup>The programs' combined life-cycle cost estimate is \$27.6 billion. This amount includes \$12.4 billion for the Chemical Stockpile Disposal Program and \$15.2 billion for the Nonstockpile Chemical Materiel Program.

<sup>2</sup>Chemical Weapons and Materiel: Key Factors Affecting Disposal Costs and Schedule (GAO/NSIAD-97-18, Feb. 10, 1997).

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The Chemical Stockpile Disposal Program's cost and schedule are largely driven by the degree to which states and local communities are in agreement with the proposed disposal method at the remaining stockpile sites. Based on program experience, reaching agreement has consistently taken longer than the Army anticipated. For example, the Army has consistently underestimated the time required to obtain environmental permits for the disposal facilities. Until DOD and the affected states and localities reach agreement on a disposal method for the remaining stockpile sites, the Army will not be able to predict the Chemical Stockpile Disposal Program's cost and schedule with any degree of accuracy.

Moreover, many of the problems experienced in the stockpile program are also likely to affect the Army's ability to implement the Nonstockpile Chemical Materiel Program. For example, efforts to dispose of nonstockpile materiel are likely to be driven by the need to obtain state and local approvals for destruction methods. In addition, more time is needed for the Army to prove that its proposed disposal method for the nonstockpile program will be safe and effective and accepted by the affected states and localities.

Notwithstanding these issues, DOD and the Army have taken actions in response to congressional direction and our recommendations to improve program management. In December 1994, DOD designated the Army's chemical demilitarization program, consisting of both stockpile and nonstockpile munitions and materiel, as a major defense acquisition program. The objectives of the designation were to stabilize the disposal schedules, control costs, and provide more discipline and higher levels of program oversight. In addition, Army officials have identified cost-reduction initiatives, which are in various stages of assessment, that could reduce program costs by \$673 million.

Recognizing the difficulty of satisfactorily resolving the public concerns associated with each individual disposal location, suggestions have been made by members of the Congress, DOD officials, and others to change the programs' basic approach to destruction. However, the suggestions create trade-offs for decisionmakers and would require changes in existing legal requirements. These suggestions have included deferring plans for additional disposal facilities until an acceptable alternative technology to incineration is developed, consolidating disposal operations at a national site or regional sites, destroying selected nonstockpile chemical warfare materiel in stockpile disposal facilities, establishing a centralized disposal

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facility for nonstockpile materiel, and modifying laws and regulations to standardize environmental requirements.

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## Background

In 1985, the Congress passed Public Law 99-145 directing the Army to destroy the U.S. stockpile of lethal chemical agents and munitions. The stockpile consists of rockets, bombs, projectiles, spray tanks, and bulk containers, which contain nerve and mustard agents. It is stored at eight sites in the continental United States and on Johnston Atoll in the Pacific Ocean. Appendix III identifies the locations of the chemical stockpile storage sites. To comply with congressional direction, the Army established the Chemical Stockpile Disposal Program and developed a plan to incinerate the agents and munitions on site in specially designed facilities. In 1988, the Army established the Chemical Stockpile Emergency Preparedness Project (CSEPP) to help communities near the chemical stockpile storage sites enhance existing emergency management and response capabilities in the unlikely event of a chemical stockpile accident.

Recognizing that the stockpile program did not include all chemical warfare materiel requiring disposal, the Congress directed the Army in 1992 to plan for the disposal of materiel not included in the stockpile. This materiel, some of which dates back to World War I, consists of binary chemical weapons, miscellaneous chemical warfare materiel, recovered chemical weapons, former production facilities, and buried chemical warfare materiel.<sup>3</sup> Appendix IV identifies the storage locations for the nonstockpile chemical warfare materiel. In 1992, the Army established the Nonstockpile Chemical Materiel Program to dispose of the materiel.

Appendix V provides a chronology of the Army's chemical disposal programs.

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## Potential Impact of the Chemical Weapons Convention

In 1993, the United States signed the U.N.-sponsored Chemical Weapons Convention. In October 1996, the 65th nation ratified the convention making the treaty effective on April 29, 1997.<sup>4</sup> If the U.S. Senate approves

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<sup>3</sup>Binary weapons are formed from two nonlethal elements through a chemical reaction after the munitions are fired or launched. The weapons were manufactured, stored, and transported with only one of the chemical elements in the weapon. The second element was to be loaded into the weapon at the battlefield.

<sup>4</sup>The convention becomes effective 180 days after the 65th nation ratified the treaty.

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the convention, it could affect implementation of the disposal programs.<sup>5</sup> Through ratification, the United States will agree to dispose of its (1) unitary chemical weapons stockpile, binary chemical weapons, recovered chemical weapons, and former chemical weapon production facilities by April 29, 2007, and (2) miscellaneous chemical warfare materiel by April 29, 2002. If a country is unable to maintain the convention's disposal schedule, the convention's Organization for the Prohibition of Chemical Weapons may grant a one-time extension of up to 5 years. Under the terms of the convention, chemical warfare materiel buried before 1977 is exempt from disposal as long as it remains buried. Should the United States choose to excavate the sites and remove the chemical materiel, the provisions of the convention would apply. The Senate has not approved the convention, however, the United States is committed by public law to destroying its chemical stockpile and related warfare materiel.

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## Our Prior Reports Noted Cost and Schedule Issues

In prior reports, we expressed concern about the Army's lack of progress and the rising cost of the disposal programs. Appendix VI provides a listing of our products related to these programs. In 1991, we reported that continued problems in the program indicated that increased costs and additional time to destroy the chemical stockpile should be expected. We recommended that the Army determine whether faster and less costly technologies were available to destroy the stockpile.<sup>6</sup> In a 1995 report on the nonstockpile program, we concluded that the Army's plans for disposing of nonstockpile chemical warfare materiel were not final and, as a result, its cost estimate was likely to change.<sup>7</sup> In July 1995, we testified before this subcommittee that the Army had experienced significant cost growth and delays in executing its stockpile disposal program and that further cost growth and schedule slippages could occur.<sup>8</sup> In 1996, we reported that efforts to enhance emergency preparedness in Alabama had been hampered by management weaknesses in CSEPP.<sup>9</sup>

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<sup>5</sup>Under the U.S. Constitution, treaties must be approved by a two-thirds majority of the Senate.

<sup>6</sup>Chemical Weapons: Stockpile Destruction Cost Growth and Schedule Slippages Are Likely to Continue (GAO/NSIAD-92-18, Nov. 20, 1991).

<sup>7</sup>Chemical Weapons Disposal: Plans for Nonstockpile Chemical Warfare Materiel Can Be Improved (GAO/NSIAD-95-55, Dec. 20, 1994).

<sup>8</sup>Chemical Weapons Disposal: Issues Related to DOD's Management (GAO/T-NSIAD-95-185, July 13, 1995).

<sup>9</sup>Chemical Weapons Stockpile: Emergency Preparedness in Alabama Is Hampered by Management Weaknesses (GAO/NSIAD-96-150, July 23, 1996).

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## Stockpile Program's Cost and Schedule Are Uncertain but Will Exceed Current Estimates

The stockpile program will likely exceed its \$12.4 billion estimate and take longer than the legislative completion date of December 2004.<sup>10</sup> This is because reaching agreement on site-specific disposal methods has consistently taken longer than the Army anticipated. Public concerns about the safety of incineration have (1) resulted in additional environmental requirements, (2) slowed the permitting of new incinerators, and (3) required the Army to research disposal alternatives.

Approximately \$1 billion of the estimated \$12.4 billion is associated with CSEPP. The cost estimate for CSEPP has increased because of delays in the stockpile program and longstanding management weaknesses. These weaknesses have also slowed the program's progress in enhancing emergency preparedness.

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## Cost Growth and Schedule Slippages

Since 1985, the Army's cost estimate for the stockpile disposal program has increased seven-fold, from an initial estimate of \$1.7 billion to \$12.4 billion, and the planned completion date has been delayed from 1994 to 2004. Although the Army is committed to destroying the stockpile by the legislatively imposed deadline of December 31, 2004, it is unlikely to meet that date. Only two of the nine planned disposal facilities are built and operating, 4 percent of the stockpile has been destroyed, and environmental permitting issues at the individual sites continue to delay construction of the remaining facilities. For example, since the Army developed the most recent cost and schedule estimate in February 1996, the plant construction schedule has slipped by 6 months at the Anniston Army Depot, 9 months at the Pine Bluff Arsenal, 10 months at the Pueblo Depot Activity, and 4 months at the Umatilla Depot Activity.

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## Reaching Agreement on Environmental Issues Has Been a Lengthy Process

Predicting the disposal schedule for the various sites is difficult. According to Army officials, this is partly due to the uncertainty of the time required to satisfy changing environmental requirements. For example, although based on federal requirements, individual state environmental requirements differ and are occasionally changed. In most cases, these changes have added unanticipated requirements, resulting in the need for additional data collection, research, and reporting by the Army.

In addition, according to the Army, the original scope of the health risk assessment to operate the disposal facilities was not completely defined,

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<sup>10</sup>Through fiscal year 1997, the Congress has appropriated \$4 billion and the Army estimates that it will require \$8.4 billion to complete the program.



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the health assessment requirements have changed, and the requirements currently vary from state to state. According to DOD officials, states have modified the requirements of their health risk assessments well into the process, delaying the development of the final assessment document.

Based on program experience, the Army's 1996 schedule does not provide sufficient time for the Army to complete the environmental approval process.<sup>11</sup> As a result, program delays past the mandated completion date of December 2004 are likely. For example, the schedule for the Anniston disposal facility includes a grace period of a month for any slippage in the construction, systemization, or operation to meet the legislative completion date of December 31, 2004. Although the Army estimated that the permit would have been issued by the end of September 1996, Alabama regulatory officials expect the permit to be issued in June or July 1997—a slippage of about 8 months in the schedule. This slippage will cause disposal operations at Anniston to extend to the middle of 2005.

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### Considering Alternative Technologies Has Affected Disposal Cost and Schedule

In the 1993 National Defense Authorization Act, the Congress directed the Army to report on potential technological alternatives to incineration. Consequently, in August 1994, the Army initiated a program to investigate, develop, and support testing of alternative disposal technologies for the two bulk-only stockpile sites—Aberdeen Proving Ground and Newport Chemical Activity. According to the National Research Council, the Army has successfully involved the state and the public in its alternative technology project for the two bulk-only stockpile sites, demonstrating the importance of public involvement to the progress of a program.<sup>12</sup> The development of alternative disposal technologies for assembled chemical munitions provides the Army the mechanism for encouraging public involvement and establishing common objectives for the remaining disposal sites.

In the 1997 National Defense Authorization Act, the Congress directed DOD to assess alternative technologies for the disposal of assembled chemical munitions. The act also directed the Secretary of Defense to report on the assessment by December 31, 1997. Similarly, the 1997 DOD Appropriations Act provided \$40 million to conduct a pilot program to identify and demonstrate two or more alternatives to the baseline incineration process

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<sup>11</sup>Department of Defense's Interim Status Assessment for the Chemical Demilitarization Program, DOD (Apr. 15, 1996).

<sup>12</sup>Public Involvement and the Army Chemical Stockpile Disposal Program, National Research Council (Oct. 25, 1996).

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for the disposal of assembled chemical munitions. The act also prohibited DOD from obligating any funds for constructing disposal facilities at the Blue Grass Army Depot and Pueblo Depot Activity, until 180 days after the Secretary reports on the alternatives. Although the prohibition applies only to Blue Grass and Pueblo, public concerns about incineration may prompt state regulators at other locations to delay their final decisions to permit incinerators until the Secretary reports his findings.

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### Management Weaknesses and Disagreements Have Slowed the Progress of CSEPP

The Army's and the Federal Emergency Management Agency's (FEMA) joint management of CSEPP has not been effective in controlling the growth in program costs and achieving timely results. The Army's current life-cycle cost estimate of \$1.03 billion for the program has increased by 800 percent over the initial estimate of \$114 million in 1988. The primary reasons for the cost increase are the 10-year slippage in the completion of the Chemical Stockpile Disposal Program and financial management weaknesses. Program management weaknesses have also contributed to the increase and resulted in slow progress in enhancing emergency preparedness in the 10 states and local communities near the chemical stockpile storage sites. Nine years after CSEPP's inception, states and local communities still lack critical items for responding to a chemical stockpile emergency, including alert and notification systems, decontamination units, and personal protection equipment.

Although the Army has responded to this criticism and taken actions in response to congressional direction to improve program management, the completion of these actions has been delayed by disagreements between Army and FEMA officials. For example, the Army is still working to respond to direction in the 1997 National Defense Authorization Act to report on the implementation and success of CSEPP Integrated Process Teams.<sup>13</sup> Because of this and other differences regarding their roles and responsibilities, Army and FEMA officials have not reached agreement on a long term management structure for CSEPP.

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<sup>13</sup>In the 1997 National Defense Authorization Act (Public Law 104-201), the Congress directed the Secretary of the Army to submit a report within 120 days of the act's enactment that assessed the implementation and success of the site-specific Integrated Process Teams.



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## Nonstockpile Program's Cost and Schedule Are Also Uncertain

Through fiscal year 1997 the Congress has appropriated \$221 million for the nonstockpile program. The Army estimates that it will require an additional \$15 billion and nearly 40 years to complete the program. However, given the factors driving the program, it is uncertain how long the program will take or cost. The program is driven by the uncertainties surrounding buried chemical warfare materiel and unproven disposal methods.

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## Buried Materiel Will Drive Cost but Little Is Known About Them

The Army estimates that it can dispose of binary weapons, recovered chemical weapons, former production facilities, and miscellaneous chemical warfare materiel within the time frames established by the Chemical Weapons Convention. Under the terms of the convention, chemical warfare materiel buried before 1977 is exempt from disposal as long as it remains buried. Although the Army estimates that buried chemical materiel accounts for \$14.5 billion (95 percent) of the nonstockpile program cost, the Army is still exploring potential sites and has little and often imprecise information about the type and amount of materiel buried. Appendix VII identifies the potential locations with buried chemical warfare materiel. The Army estimated that it will take until 2033 to identify, recover, and dispose of buried nonstockpile materiel.

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## Proposed Disposal Systems Are Not Yet Proven Effective and Acceptable by the Public

Although Army officials are confident that the proposed disposal systems will function as planned, the Army needs more time to prove that the systems will safely and effectively destroy all nonstockpile materiel and be accepted by the affected states and communities. The Army's disposal concept is based on developing mobile systems capable of moving from one location to the next where the munitions are remotely detoxified and the waste is transported to a commercial hazardous waste facility. Although the systems may operate in a semi-fixed mode, they are scheduled to be available for mobile use at recovered and burial sites after 1998.

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## Environmental Issues Will Also Affect Cost and Schedule

Environmental issues similar to those experienced in the stockpile program are also likely to affect the Army's ability to obtain the environmental approvals and permits that virtually all nonstockpile activities require. Whether the systems are allowed to operate at a particular location will depend on the state regulatory agency with authority over the disposal operations. In addition, public acceptance or

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rejection of the mobile systems will affect their transportation plans and disposal operations.

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## **Actions the Army Has Taken to Improve the Disposal Programs**

DOD and the Army have taken a number of steps to respond to congressional direction and independent reviews and improve their management and oversight of the stockpile and nonstockpile programs. These steps have included efforts to improve coordination with the public through an enhanced public outreach program, increase public involvement in the alternative technology program for the two bulk-only stockpile sites, and establish a joint CSEPP Army/FEMA team to coordinate and implement emergency preparedness activities.

In December 1994, DOD designated the Army's chemical demilitarization program, consisting of both stockpile and nonstockpile munitions and materiel, as a major defense acquisition program. The objectives of the designation were to stabilize the disposal schedules, control costs, and provide more discipline and higher levels of program oversight.<sup>14</sup>

In response to our recommendations and similar ones by the National Research Council, the Army initiated the Enhanced Stockpile Surveillance Program in 1995 to improve its monitoring and inspection of chemical munitions. On the basis of those activities, the Army estimates that the stockpile will be reasonably stable through 2013.

The Army's review of the stockpile disposal program has identified several promising cost-reduction initiatives, but the Army cannot implement some of the more significant initiatives without the cooperation and approval of state regulatory agencies. Army officials estimated that the initial cost-reduction initiatives, which are in various stages of assessment, could potentially reduce program costs by \$673 million. The Army plans to identify additional cost-reductions as the stockpile program progresses.

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## **Alternatives to the Army's Basic Approach to Destruction**

Recognizing the difficulty of resolving the public concerns associated with each individual disposal location, suggestions have been made to change the programs' basic approach to destruction. For example, members of the Congress and officials from environmental groups and affected states and counties have suggested deferring plans for additional disposal facilities until an acceptable alternative technology to incineration is developed.

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<sup>14</sup>The designation transferred management responsibility to the Assistant Secretary of the Army (Research, Development, and Acquisition) and required the program manager to develop a cost and schedule baseline and prepare quarterly and annual reports on variances from the baseline.

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Congressional members have also suggested consolidating disposal operations at a national or regional sites. In addition, officials of various DOD organizations have suggested destroying selected nonstockpile chemical warfare materiel in stockpile disposal facilities, establishing a centralized disposal facility for nonstockpile materiel, and modifying laws and regulations to standardize environmental requirements.

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### Deferring Incineration Until an Acceptable Alternative Is Developed

Deferring disposal operations may eliminate much of the public concern that has influenced the current approach to destroying the chemical stockpile. According to Army officials, alternative technologies may not reduce costs or shorten disposal operations but are likely to be acceptable to a larger segment of the public than incineration. Given the current status of alternative technologies, the cost and schedule would remain uncertain and there would be a corresponding increase in the risk of an accident from continued storage of the munitions. Although the Army has been researching technological alternatives to incineration for chemical agents stored in bulk containers, only recently have research and testing demonstrated potentially effective alternatives. Currently, there is no proven alternative technology to incineration capable of safely and effectively destroying assembled chemical munitions.

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### Consolidating Disposal Operations at a National Site or Regional Sites

Consolidating disposal operations could reduce construction and procurement costs, but the required transportation of chemical munitions could be an insurmountable barrier. This option would extend the disposal schedule and result in increased risk not only from storage but also from handling and transportation. Although consolidating disposal operations could reduce estimated facility construction and operation costs by as much as \$2.6 billion, the savings would be reduced by uncertain but potentially significant transportation and emergency preparedness costs. To help reduce costs, the Army would have to consolidate three or more stockpile sites, develop less expensive transportation containers, and control emergency response costs. In 1988, the Army and many in the Congress rejected transporting the chemical stockpile weapons to a national site or regional disposal sites because of the increased risk to the public and the environment from moving the munitions. DOD and Army officials continue to be concerned about the safety of moving chemical weapons and public opposition to transportation of the munitions has grown since 1988.

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### Destroying Selected Nonstockpile Materiel in Stockpile Facilities

Using the chemical stockpile facilities to destroy nonstockpile chemical materiel has the potential for reducing costs. Although selected nonstockpile items could be destroyed in stockpile disposal facilities, the 1986 DOD Authorization Act, and subsequent legislation, specifies that the chemical stockpile disposal facilities may not be used for any purpose other than the disposal of stockpile weapons. This legislative provision, in some cases, necessitates that the Army implement separate disposal operations for nonstockpile materiel along side of the stockpile facilities. In its 1995 implementation plan, the Army suggested that the stockpile disposal facilities could be used to process some nonstockpile weapons, depending on the location, the type of chemical weapon or materiel, and condition.<sup>15</sup>

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### Destroying Nonstockpile Materiel in a Central Facility

Another method for destroying nonstockpile chemical materiel could be based on the use of a central disposal facility with equipment designed specifically for destroying nonstockpile materiel. Although a national disposal facility could reduce program costs, the legislative restrictions on the transportation of nonstockpile chemical material and the prevalent public attitude that such a disposal facility should not be located in their vicinity would be significant obstacles that would have to be resolved.

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### Modifying Laws and Regulations

Modifying laws and regulations to standardize environmental requirements could enhance both the stockpile and nonstockpile programs' stability and control costs. The current process of individual states establishing their own environmental laws and requirements and the prevalent public attitude that the Army's disposal facilities should not be located in their vicinity have been obstacles to the stockpile disposal program and are also likely to affect the nonstockpile program. For example, individual state environmental requirements differ, such as the number of required trail burns, and are occasionally changed. As a result, there are no standard environmental procedures and requirements for stockpile and nonstockpile disposal sites. According to the Army, establishing standardized environmental requirements for all disposal sites would enhance the programs' stability. However, efforts to modify existing laws and regulations to standardize the environmental requirements for chemical weapons disposal would likely be resisted by the affected states and localities and environmental organizations.

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<sup>15</sup>Non-Stockpile Chemical Materiel Program Implementation Plan, U.S. Army Program Manager for Chemical Demilitarization (Aug. 1995).

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## Conclusions

In summary, implementation of the disposal programs has been slowed due to the lack of consensus among DOD and the affected states and localities over the process to dispose of chemical munitions and materiel. Recognizing the difficulty of satisfactorily resolving the public concerns with the disposal of chemical munitions, suggestions have been made by members of the Congress, DOD officials, and others to change the Army's basic approach to destruction. However, these suggestions create trade-offs for decisionmakers and would require changes in legal requirements. While our February report presented these suggestions, we did not take a position on them or the Army's current approach given the associated policy and legislative implications. Rather, our report presented the suggestions in context of the trade-offs they present and noted that should the Congress decide to consider modifications or alternatives to the current approach, it may wish to consider the suggestions related to the creation of alternative technologies, consolidation of stockpile disposal operations, utilization of stockpile facilities for nonstockpile items, centralization of nonstockpile destruction, and standardization of environmental laws and requirements.

In commenting on these suggestions, DOD said that it favored the Congress considering the ones to establish a centralized disposal facility for nonstockpile materiel and to modify laws and regulations to standardize environmental requirements for chemical weapons disposal. DOD recommended against consideration of the options to defer incineration plans, consolidate disposal operations, and to use stockpile facilities for destroying nonstockpile items.

In addition, we believe that high-level management attention is needed to reach agreement on a long-term management structure for CSEPP that clearly defines the roles and responsibilities of Army and FEMA personnel.

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This concludes my statement, Mr. Chairman. I would be pleased to answer any questions that you or other members of the Subcommittee may have.





# Appropriation, Obligation, and Disbursement Data for Fiscal Years 1988 Through 1997

The following tables show appropriation, obligation, and disbursement data for the disposal programs. Funding data for the Chemical Stockpile Disposal Program, Alternative Technology and Approaches Project, and Chemical Stockpile Emergency Preparedness Project are shown in tables I.1, I.2, and I.3, respectively. Funding data for the Nonstockpile Chemical Materiel Program are shown in table I.4.

**Table I.1: Chemical Stockpile Disposal Program**

Dollars in millions			
Fiscal year	Appropriated	Obligated	Disbursed
1988	\$195.8	\$194.3	\$192.9
1989	168.0	165.5	165.4
1990	210.4	208.2	205.9
1991	255.0	252.3	251.5
1992	331.3	330.1	326.8
1993	419.1	417.9	316.0
1994	249.1	246.7	234.9
1995	486.5	472.2	279.2
1996	484.2	346.0	130.5
1997	534.7		
<b>Total</b>	<b>\$3,334.1</b>	<b>\$2,633.2</b>	<b>\$2,103.1</b>

**Table I.2: Alternative Technology and Approaches Project**

Dollars in millions			
Fiscal year	Appropriated	Obligated	Disbursed
1994	\$22.4	\$22.2	\$10.2
1995	9.4	9.4	6.8
1996	22.2	19.6	12.2
1997	56.0		
<b>Total</b>	<b>\$110.0</b>	<b>\$51.2</b>	<b>\$29.2</b>

**Appendix I**  
**Appropriation, Obligation, and**  
**Disbursement Data for Fiscal Years 1988**  
**Through 1997**

**Table I.3: Chemical Stockpile  
Emergency Preparedness Project**

Dollars in millions

<b>Fiscal year</b>	<b>Appropriated</b>	<b>Obligated</b>	<b>Disbursed</b>
1988	\$2.5	\$2.5	\$2.5
1989	11.3	11.3	11.1
1990	43.8	43.7	43.3
1991	37.7	37.6	37.5
1992	40.9	40.5	40.0
1993	88.2	87.5	62.1
1994	71.9	71.6	65.5
1995	56.5	56.4	27.6
1996	80.0	65.2	27.3
1997	82.4		
<b>Total</b>	<b>\$515.2</b>	<b>\$416.3</b>	<b>\$316.9</b>

**Table I.4: Nonstockpile Chemical  
Materiel Program**

Dollars in millions

<b>Fiscal year</b>	<b>Appropriated</b>	<b>Obligated</b>	<b>Disbursed</b>
1992	\$2.2	\$2.2	\$2.2
1993	6.3	6.3	6.0
1994	31.5	31.2	26.4
1995	26.0	25.8	18.5
1996	69.7	40.4	14.6
1997	85.3		
<b>Total</b>	<b>\$221.0</b>	<b>\$105.9</b>	<b>\$67.7</b>

Source: The Army's Program Manager for Chemical Demilitarization.

# Estimated Program Cost for Fiscal Years 1998 Through 2005

Dollars in millions

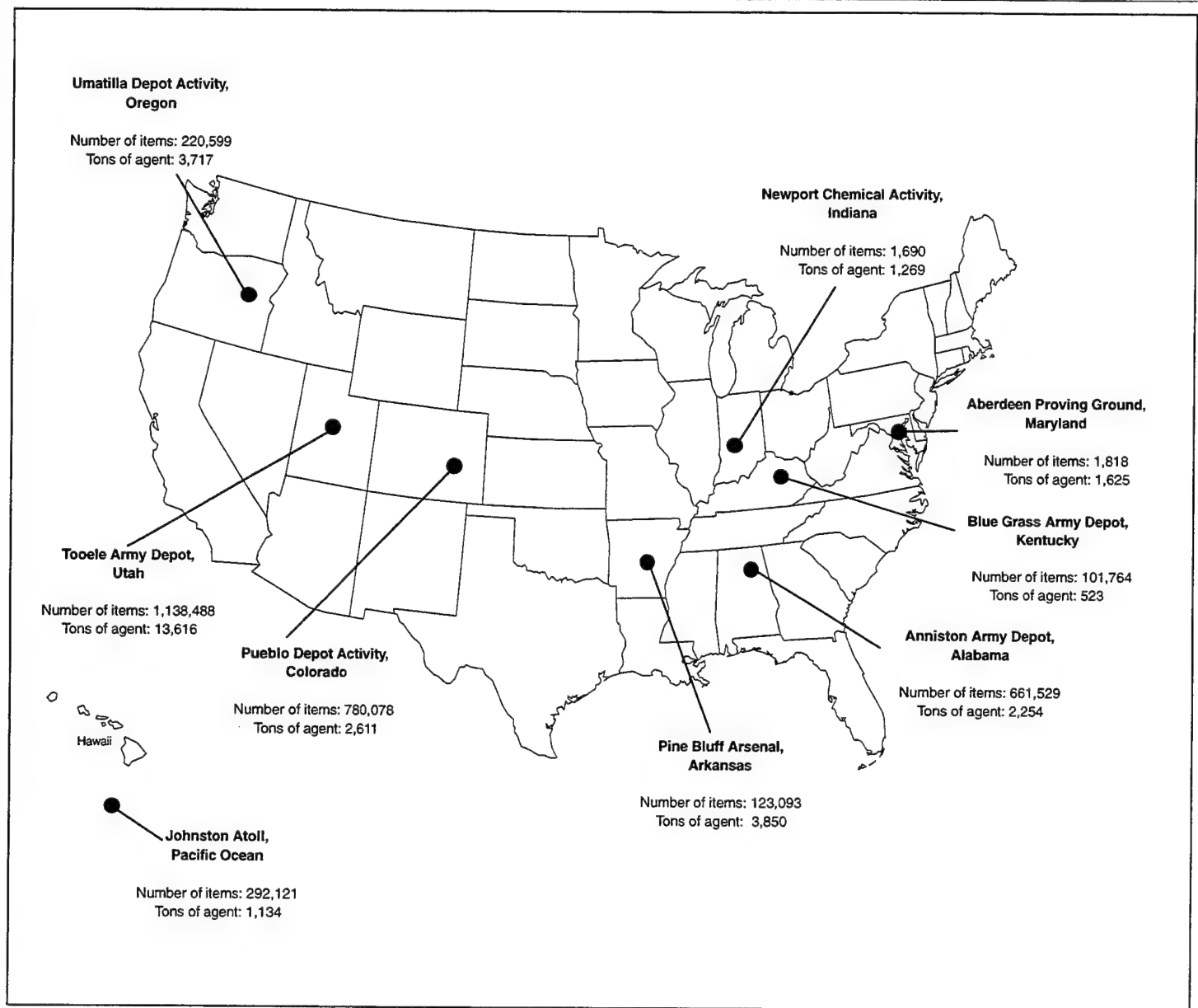
Fiscal year	Chemical Stockpile Disposal Program	Alternative Technology and Approaches Project	Chemical Stockpile Emergency Preparedness Project	Nonstockpile Chemical Materiel Program
1998	\$946.8	\$16.0	\$94.4	\$71.7
1999	960.9	30.5	66.6	174.1
2000	842.2	19.0	74.0	112.2
2001	700.2	15.0	71.3	154.4
2002	1,644.8	88.3	69.5	166.5
2003	866.2		66.2	101.7
2004	938.9		60.8	101.8
2005	235.8			55.2
<b>Total<sup>a</sup></b>	<b>\$7,135.8</b>	<b>\$168.8</b>	<b>\$502.8</b>	<b>\$937.6</b>

Note: Then-year dollars.

<sup>a</sup>Totals do not add to the Army's estimated funding to complete the programs because (1) the estimates were developed at different times and based on different assumptions and (2) the table does not reflect total costs for the nonstockpile program, which is estimated to continue through 2033.

Source: DOD's Selected Acquisition Report (June 30, 1996).

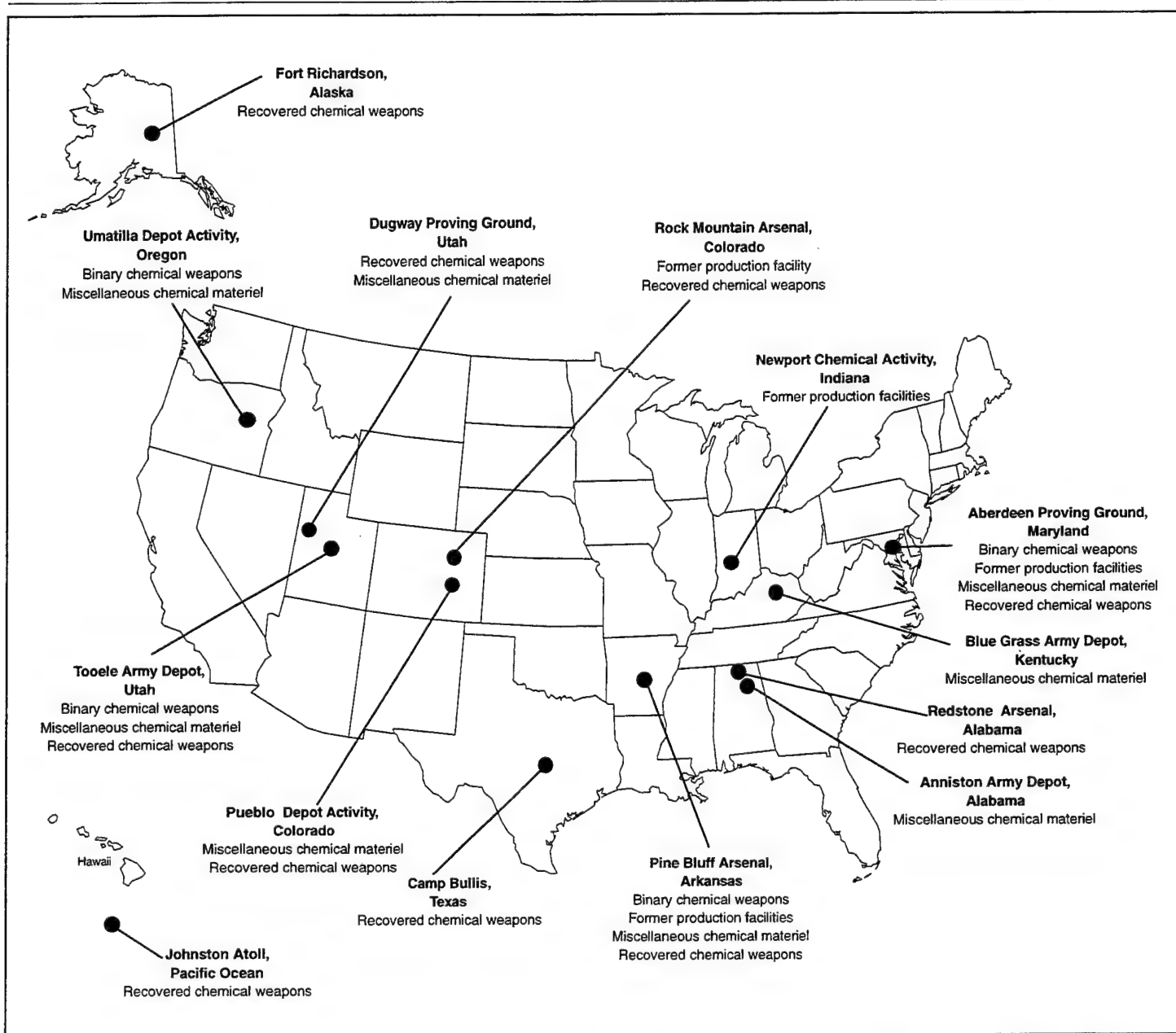
# The U.S. Stockpile of Chemical Agents and Munitions



Note: As of December 15, 1995.

Source: DOD.

# Storage Locations of Nonstockpile Chemical Warfare Materiel



Source: Based on 1996 data provided by the Army's Project Manager for Nonstockpile Chemical Materiel.

# Chronology of the U.S. Chemical Demilitarization Program

Time frame	Activity
1917-1960s	Obsolete or unserviceable chemical warfare agents and munitions were disposed of by open pit burning, land burial, and ocean dumping.
1969	The National Academy of Sciences recommended that ocean dumping be avoided and that public health and environmental protection be emphasized. It suggested two alternatives to ocean disposal: chemical neutralization of nerve agents and incineration of mustard agents.
1970	The Armed Forces Authorization Act (P.L. 91-441) required a Department of Health and Human Services review of any disposal plans and detoxification of weapons prior to disposal. It also limited the movement of chemical weapons.
1971	The Foreign Military Sales Act prohibited the transportation of U.S. chemical weapons from Okinawa, Japan, to the continental United States. The weapons were moved to Johnston Atoll in the Pacific Ocean.
1971-1973	The Army tested and developed an incineration process and disposed of several thousand tons of mustard agent stored in ton containers at Rocky Mountain Arsenal.
1973-1976	The Army disposed of nearly 4,200 tons of nerve agent by chemical neutralization at Tooele Army Depot and Rocky Mountain Arsenal. The process was problematic and not very reproducible, making automation difficult.
1979	The Army opened the Chemical Agent Munitions Disposal System at Tooele to test and evaluate disposal equipment and processes for chemical agents and munitions on a pilot scale.
1981	The Army decided to build the Johnston Atoll Chemical Agent Disposal System to dispose of its chemical M55 rocket stockpile.
1981-1986	The Army used the Chemical Agent Munitions Disposal System to test and evaluate incineration of chemical agents and energetic materiel, and decontamination of metal parts and ton containers.
1982	An Arthur D. Little Corporation study for the Army concluded that using incineration, rather than neutralization, to dispose of the stockpile would reduce costs.
1982	The Army declared its stockpile of M55 rockets obsolete.
1983	The Army expanded its chemical disposal program to include the M55 rocket stockpile at Anniston Army Depot, Umatilla Depot Activity, and Blue Grass Army Depot.
1984	The Army expanded its chemical disposal program to include the M55 rocket stockpile at Pine Bluff Arsenal and Tooele Army Depot.
1984	The National Research Council endorsed the Army's disassembly and high-temperature incineration process for disposing of chemical agents and munitions. It also recommended that the Army continue to store most of the chemical stockpile, dispose of the M55 rockets, and analyze alternative methods for disposing of the remaining chemical stockpile.
1985	The Army began construction of the Johnston Atoll Chemical Agent Disposal System.
1985	The DOD Authorization Act for Fiscal Year 1986 (P.L. 99-145) mandated the destruction of the U.S. stockpile of lethal chemical agents and munitions. It also required that the disposal facilities be cleaned, dismantled, and disposed of according to applicable laws and regulations.
1986	The DOD Appropriations Act for Fiscal Year 1987 (P.L. 99-500) prohibited shipments of chemical weapons, components, or agents to the Blue Grass Depot Activity for any purpose.
1987	Chemical Agent Munitions Disposal System operations were suspended as a result of a low-level nerve agent release.
1988	The Army issued the Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program. The Army selected on-site disposal of the chemical stockpile because it posed fewer potential risks than transportation and off-site disposal.

(continued)



**Appendix V**  
**Chronology of the U.S. Chemical**  
**Demilitarization Program**

<b>Time frame</b>	<b>Activity</b>
1988	The National Defense Act of Fiscal Year 1989 (P.L. 100-456) required the Army to complete operational verification testing at Johnston Atoll before beginning to systematize similar disposal facilities in the continental United States.
1989	The Army started construction of the chemical demilitarization facility at Tooele Army Depot.
1990	The Army completed the successful retrograde of all chemical munitions stored in Germany to storage facilities at Johnston Atoll.
1990	The Army initiated disposal of M55 rockets at Johnston Atoll.
1990	A very small amount of nerve agent leaked through the common stack during maintenance activities at Johnston Atoll. The agent release was below allowable stack concentration.
1990-1993	The Army completed four operational verification tests at the Johnston Atoll Chemical Agent Disposal System. During the test, the Army destroyed more than 40,000 munitions containing nerve and mustard agents. In August 1993, the Secretary of Defense certified to the Congress that the Army has successfully completed the operational verification tests at Johnston Atoll.
1991	The National Defense Authorization Act for Fiscal Year 1991 (P.L. 101-510) restricted the use of funds to transport chemical weapons to Johnston Atoll except for U.S. munitions discovered in the Pacific, prohibited the Army from studying the movement of chemical munitions, and established the emergency preparedness program.
1991	The Army moved 109 World War II mustard-filled projectiles from the Solomon Islands to Johnston Atoll for storage and disposal.
1991	The National Defense Authorization Act for Fiscal Years 1992 and 1993 (P.L. 102-190) required the Secretary of Defense to develop a chemical weapons stockpile safety contingency plan.
1992	The U.S. Army Chemical Materiel Destruction Agency was established to consolidate operational responsibility for the destruction of chemical warfare capabilities into one office.
1992	The National Defense Authorization Act for Fiscal Year 1993 (P.L. 102-484) directed the Army to establish citizens' commissions for states with storage sites, if the state's governor requested one. It also required the Army to report on (1) disposal alternatives to the baseline incineration method and (2) plans for destroying U.S. nonstockpile chemical weapons and materiel identified in the Chemical Weapons Convention.
1993	The Johnston Atoll Chemical Agent Disposal System was shut down during operation and verification tests when residue explosive material generated during the processing of M60 105mm projectiles caught fire, causing damage to a conveyor belt and other equipment in the explosive containment room.
1993	The Army completed construction and started systemization of the Tooele Chemical Agent Disposal Facility.
1993	The Army issued its report on the physical and chemical integrity of the chemical stockpile to the Congress.
1993	A mustard leak from a ton container was discovered at Tooele Army Depot.
1993	The Army issued an interim survey and analysis report on the Nonstockpile Chemical Materiel Program to the Congress.
1994	Approximately 11.6 milligrams of nerve agent were released into the atmosphere at the Johnston Atoll during a maintenance activity on the liquid incinerator.
1994	The National Research Council issued its recommendations for the disposal of chemical agents and munitions to the Army.
1994	The Army issued its alternative demilitarization technology report to the Congress. The Army recommended the continuation of the chemical demilitarization program without deliberate delay and the implementation of a two-technology research and development program.

(continued)

**Appendix V**  
**Chronology of the U.S. Chemical**  
**Demilitarization Program**

<b>Time frame</b>	<b>Activity</b>
1994	The Army issued its M55 rocket stability report to the Congress. The report recommended that an enhanced stockpile assessment program be initiated to better characterize the state of the M55 rocket in the stockpile.
1994	The Army initiated the Alternative Technology Project to develop an alternative disposal technology to the baseline incineration process for the bulk-only stockpile locations in Maryland and Indiana. This research and development effort is conducted in conjunction with activities to implement the baseline program.
1994	The U.S. Army Chemical Materiel Destruction Agency was redesignated the U.S. Army Chemical Demilitarization and Remediation Activity after a merger with the U.S. Army Chemical and Biological Defense Command. In addition, the Army restructured and centralized its chemical stockpile emergency preparedness program to streamline procedures, enhance responsiveness of operations, and improve the budgeting process.
1994	The Assistant Secretary of the Army for Research, Development and Acquisition became the DOD Executive Agent for the Chemical Demilitarization Program, replacing the Assistant Secretary of the Army for Installations, Logistics, and Environment. The Chemical Demilitarization Program was designated a DOD Acquisition Category 1D Program.
1995	The Army initiated the Enhanced Stockpile Surveillance Program to investigate, develop, and support methods to improve monitoring and inspection of chemical munitions.
1995	The U.S. Army Chemical Demilitarization and Remediation Activity was renamed the Program Manager for Chemical Demilitarization.
1995	The Johnston Atoll Chemical Agent Disposal System surpassed the 1-million pounds target and completed the disposal of all M55 rockets stored on Johnston Atoll. Disposal rates exceeded established goals.
1995	A perimeter monitor located about 100 yards from the demilitarization building at Johnston Atoll detected a trace level of nerve agent. The source of the leak was identified as a door gasket in the air filtration system. Temporary air locks were erected and the gasket replaced. No one was harmed from this event.
1995	The Army awarded the contract for small burial sites and issued its implementation plan for the nonstockpile program.
1995	The Tooele Chemical Agent Disposal Facility completed equipment systemization testing.
1995	The Army certified to the Congress that all Browder Amendment requirements for the award of the Anniston construction contract were met.
1996	The National Defense Authorization Act for Fiscal Year 1996 (P.L. 104-106) directed DOD to conduct an assessment of the Chemical Stockpile Disposal Program and options that could be taken to reduce program costs.
1996	The Army completed disposal of all Air Force and Navy bombs stored on Johnston Atoll ahead of schedule.
1996	The Army awarded the systems contract for the construction, operation, and closure of the proposed Anniston Chemical Agent Disposal Facility. Construction of the facility is scheduled to begin after the state of Alabama issues the environmental permits.
1996	The Army started disposal operations at the Tooele Chemical Agent Disposal Facility. Shortly after the start, operations were shut down for a week after a small amount of agent was detected in a sealed vestibule attached to the air filtration system. No agent was released to the environment and no one was harmed.
1996	Several hair line cracks were discovered in the concrete floor of the Tooele disposal facility's decontamination area. The cracks caused a small amount of decontamination solution to leak to a electrical room below. No agent was detected and the cracks were sealed.

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**Appendix V**  
**Chronology of the U.S. Chemical**  
**Demilitarization Program**

<b>Time frame</b>	<b>Activity</b>
1996	The 1997 National Defense Authorization Act (P.L. 104-201) directed DOD to conduct an assessment of alternative technologies for the disposal of assembled chemical munitions. The act also directed the Secretary of Defense to report on this assessment by December 31, 1997.
1996	The 1997 DOD Appropriations Act (P.L. 104-208) provided the Army \$40 million to conduct a pilot program to identify and demonstrate two or more alternatives to the baseline incineration process for the disposal of assembled chemical munitions. The act also prohibited DOD from obligating any funds for constructing disposal facilities at Blue Grass and Pueblo until 180 days after the Secretary reports on the alternatives.
1996	The Chemical Weapons Convention was ratified by the 65th country needed to make the convention effective. As a result, the convention will go into effect April 29, 1997. Through ratification, the United States will agree to dispose of its (1) unitary chemical weapons stockpile, binary chemical weapons, recovered chemical weapons, and former chemical weapon production facilities by April 29, 2007, and (2) miscellaneous chemical warfare materiel by April 29, 2002.

# Related GAO Products

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Chemical Weapons and Materiel: Key Factors Affecting Disposal Costs and Schedule (GAO/NSIAD-97-18, Feb. 10, 1997).

Chemical Weapons Stockpile: Emergency Preparedness in Alabama Is Hampered by Management Weaknesses (GAO/NSIAD-96-150, July 23, 1996).

Chemical Weapons Disposal: Issues Related to DOD's Management (GAO/T-NSIAD-95-185, July 13, 1995).

Chemical Weapons: Army's Emergency Preparedness Program Has Financial Management Weaknesses (GAO/NSIAD-95-94, Mar. 15, 1995).

Chemical Stockpile Disposal Program Review (GAO/NSIAD-95-66R, Jan. 12, 1995).

Chemical Weapons: Stability of the U.S. Stockpile (GAO/NSIAD-95-67, Dec. 22, 1994).

Chemical Weapons Disposal: Plans for Nonstockpile Chemical Warfare Materiel Can Be Improved (GAO/NSIAD-95-55, Dec. 20, 1994).

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Chemical Weapons Destruction: Advantages and Disadvantages of Alternatives to Incineration (GAO/NSIAD-94-123, Mar. 18, 1994).

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Chemical Weapon Stockpile: Army's Emergency Preparedness Program Has Been Slow to Achieve Results (GAO/NSIAD-94-91, Feb. 22, 1994).

Chemical Weapons Storage: Communities Are Not Prepared to Respond to Emergencies (GAO/T-NSIAD-93-18, July 16, 1993).

Chemical Weapons Destruction: Issues Affecting Program Cost, Schedule, and Performance (GAO/NSIAD-93-50, Jan. 21, 1993). Chemical Weapons Destruction: Issues Related to Environmental Permitting and Testing Experience (GAO/T-NSIAD-92-43, June 16, 1992).

Chemical Weapons Disposal (GAO/NSIAD-92-219R, May 14, 1992).

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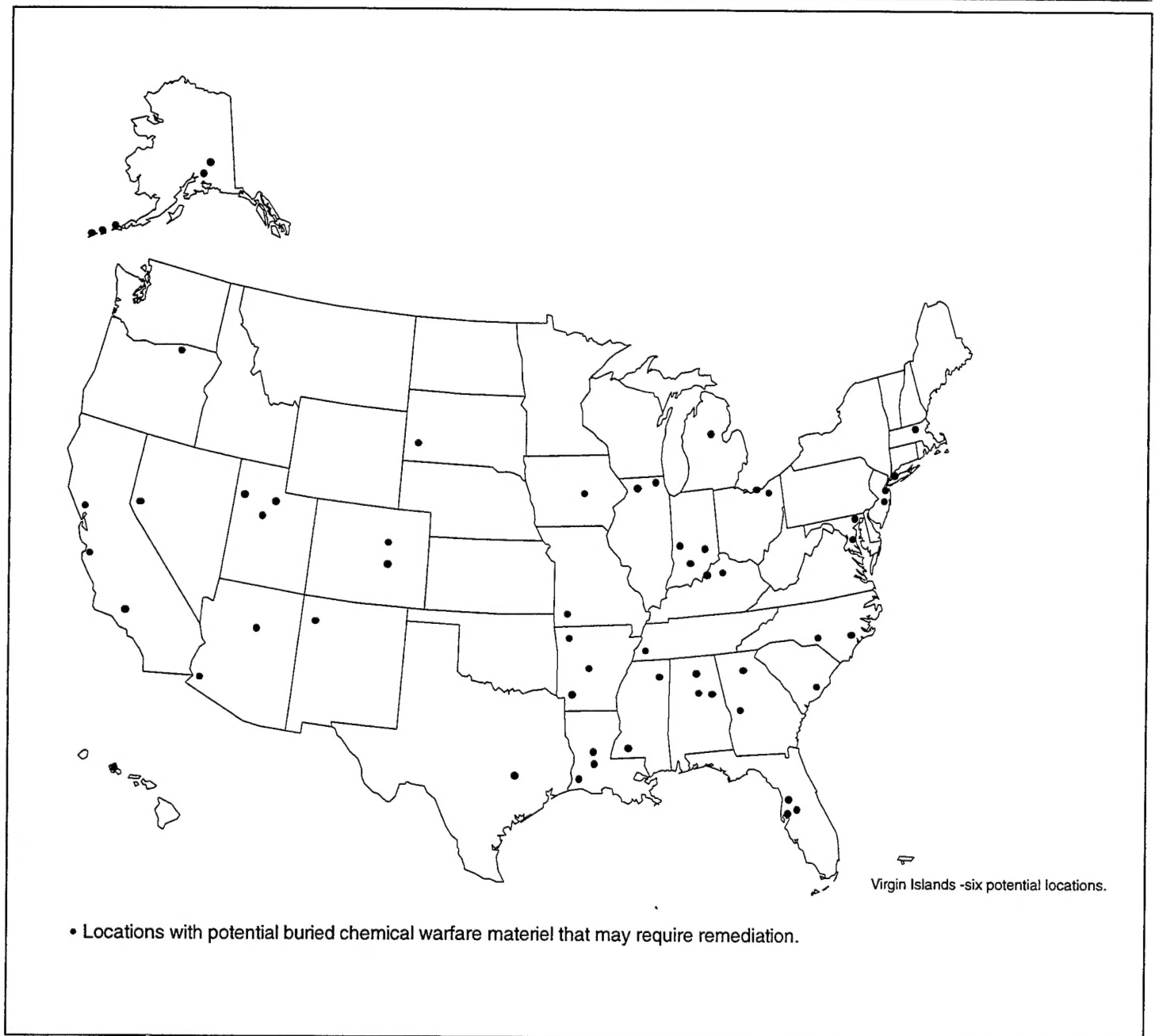
**Appendix VI**  
**Related GAO Products**

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Chemical Weapons: Stockpile Destruction Cost Growth and Schedule Slippages Are Likely to Continue (GAO/NSIAD-92-18, Nov. 20, 1991).

Chemical Warfare: DOD's Effort to Remove U.S. Chemical Weapons From Germany (GAO/NSIAD-91-105, Feb. 13, 1991).

# Potential Locations With Buried Chemical Warfare Materiel



Source: Based on 1996 data provided by the Army's Project Manager for Nonstockpile Chemical Materiel.



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